AWOP News

Area-Wide Optimization Program

Association of State Drinking Water Administrators

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Developing a State AWOP: The Targeted Performance Improvement Component

The February 2004 issue of *AWOP News* included an article that presented an overview of the Area Wide Optimization Program (AWOP). The primary goal of AWOP is to maximize public health protection through optimization of existing treatment processes at surface water treatment plants. An AWOP consists of three components: status, targeted performance improvement, and maintenance. The May 2004 issue of *AWOP News* discussed the status component, this issue will introduce the targeted performance improvement (TPI) component, and a future issue of *AWOP News* will focus on the maintenance component.

The objective of TPI is to achieve measurable performance improvement and reliability at individual plants. This is accomplished by targeting and applying specific state-sponsored activities to water systems with less than optimal performance. The targeted performance improvement component of AWOP allows states to consider activities, both those currently used by the states and new optimization tools introduced through AWOP, and determine the most appropriate use of each activity based on information provided by the state's status component. Targeted performance improvement recognizes that every plant is unique in the level of attention required from the state.

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Performance Based Training

Background

As discussed in the feature article on Targeted Performance Improvement, states developing AWOPs have Performance Based Training (PBT) as one of the optimization tools available to them. PBT incorporates the experiences and findings from years of training activities directed toward improving the performance of existing water utilities using the Composite Correction Program (CCP)[1]. The CCP is a comprehensive, systematic procedure developed to assist surface water treatment plants meet increasingly stringent regulatory requirements. The CCP consists of an evaluation component called a Comprehensive Performance Evaluation (CPE) followed by a Comprehensive Technical Assistance (CTA) component where factors limiting performance from the CPE are addressed by the plant staff in a facilitated environment.

Although the "one-on-one" approach of the CCP has been demonstrated to be effective, the CTA component of the CCP proved to be quite resource intensive. PBT was developed because of a growing demand to achieve CCP levels of improved performance at multiple facilities and maximize use of limited facilitation resources.

Development of PBT started in 1998 with several pilot projects completed over the next couple of years. Please refer to the paper by Hegg and DeMers [2] for a complete discussion of the development of PBT. As of January 2004, 65 treatment plants in 7 states had completed PBT.

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Spotlight: Alabama's Area-Wide Optimization Program

Each issue of *AWOP News* will focus on an individual state or EPA Regional office involved in an Area-Wide Optimization Program (AWOP), including the history of the program, challenges faced and lessons learned, and overall impacts of the program. This issue focuses on Alabama.

History of the Alabama AWOP Program

The AWOP program in Alabama has roots going back to the early 1990's. At that time, the Alabama Department of Environmental Management's (ADEM) Drinking Water Branch (DWB) decided that the surface water treatment plants in the state needed to go beyond the SWTR's turbidity limits in order to provide a greater level of public health protection. The DWB's management decided to enact a state goal for individual filtered turbidity of 0.2 NTU and encouraged all surface water treatment plants to meet this goal. This filtration goal was pursued until 1997.

In 1997, EPA's Technical Support Center (TSC) and Process Applications, Inc (PAI) presented the idea of AWOP to the states in Region IV. Alabama, Georgia, Kentucky and South Carolina embraced the idea and the Region IV AWOP program, the first multi-state AWOP, was founded with the first Quarterly Meeting held in Louisville, KY on November 4, 1997. After the meeting in Louisville, the engineers in the DWB decided which systems were in the most need of assistance based upon their knowledge of the systems. Ten systems where chosen and the engineers started tracking the systems' data. The engineers also started tracking the data from other plants in the state, but made the decision to only track the data for raw water, settled water and four filters to alleviate data entry problems. An Excel workbook was developed that allowed plant data to be analyzed and compared with the Optimization Goals.

In 1999, the DWB started allowing systems to submit their monthly reports to their state inspector by e-mail. These electronic reports reduced the data entry burden, especially as more and more plants started submitting their reports electronically. These electronic reports eventually allowed the engineers to start tracking all filters in each treatment plant. Also in 1999, the DWB held its first annual Surface Water Meeting in Cullman, AL. The primary focus of this meeting was to present the optimization program to the surface water treatment plants and discuss the benefits of participation in the program.

The Surface Water Meeting was relocated in 2000 to Montgomery, AL. This meeting focused on the optimization goals, but started included regulatory updates and other information. Additionally in 2000, a fourth engineer was hired into the Surface Source Section of the DWB. This fourth engineer reduced the number of systems under each engineer which allowed time to prepare for forthcoming regulations and optimization. This year also saw the introduction of Performance Based Training (PBT) to the Region IV AWOP program and the benefits of this approach were apparent.

The years 2001 through 2003 saw many optimization related activities. The DWB completed the first round of PBT from March 2001 to May 2002, the second round from September 2002 to August 2003, and started a third round of PBT in December 2003. DWB staff also conducted five microbial CPEs, assisted TSC and PAI in a disinfection byproduct CPE, and held a 1½ day Surface Water Meeting in 2001, 2002, and 2003.

The 2004 optimization schedule has been the most active one to date. Two engineers participated in Disinfection Byproduct Comprehensive Performance Evaluations (DBP CPEs) in Oklahoma and Georgia. DWB staff also conducted a multi-state DBP CPE in February 2004, completed a "PBT Lite" session (described later in this article), and completed the third round of conventional PBTs in September 2004.

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Alabama's AWOP *...continued from page 2*

The real backbone of Alabama's Optimization Program is the status component and Performance Based Training. The status component is what directs the program and identifies systems that are in most need of assistance. PBT is where Alabama is seeing the most benefit in helping systems improve performance.

Status Component

Alabama's status component is based upon three main areas. Plants are scored based upon their raw water quality (including turbidity), violations, and any plant deficiencies. Raw water quality is based upon turbidity and fecal coliform counts. Turbidities points are assigned based upon the 95th percentile of the maximum daily values taken from the combined settled water and from each individual filter. No individual filter can have a reading above 0.30 NTU. Violations are for any MCL exceedance, failure to monitor, or failure to respond to orders issued to the system. Plant deficiencies can vary, but most are for having only one treatment train, not having online monitoring equipment on each treatment unit, or insufficient contact time to meet CT with a chlorine residual of 1.0 mg/L.

A summary of the Alabama's optimization status from 1999 to 2003 is shown in Table 1. The table shows a significant improvement in plant performance in Alabama over a five year span during which the number of water plants meeting the settled goal has increased by 13.5% and the filtered water increased 28.8%.

Table 1. Percentage of plants meeting settled water and filtered water goal.

Year	Percent meeting a combined settled goal	Percent meeting filtration goal
1999	47.7	45.3
2000	57.0	57.0
2001	55.8	68.6
2002	62.8	73.3
2003	61.2	74.1

In May 2003 water plants were asked to start submitting individual sedimentation basin turbidity numbers. The results showed that in several water plants, one or more sedimentation basins where negatively impacting performance. The state has been working with these systems to improve performance of these basins. The individual sedimentation basin data will be incorporated into the 2004 status component and plant ranking which will bring Alabama completely in-line with the stated goals of the optimization program.

Performance Based Training in Alabama

The optimization diagram in Figure 1 easily shows where PBT fits into the optimization strategy. A capable plant may have good administration, design, and maintenance, but without proper operation (process control) the plant will not be optimized. Performance Based Training is a tool to help water systems optimize the operation of their water treatment plant.

Performance Based Training is a systematic approach to overcoming the "knowing-doing" gap. The "knowing-doing" gap is applying what operators learn in training in what they do at their treatment plant. This is accomplished through several sessions which focus on different issues and having water systems accept a new process control definition. In Alabama, process control is defined as "Anything you do in your water treatment plant, from backwashing a filter to cleaning the toilet."

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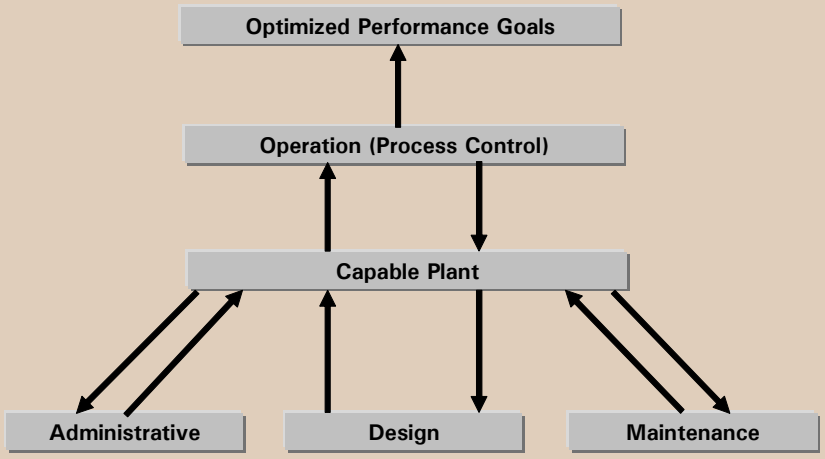
Figure 1. Optimization Diagram



Performance Based Training is a proven tool for: 1) developing water professionals; 2) helping systems achieve and sustain optimized performance; and 3) achieving results at multiple facilities. This is accomplished through presentations with hands-on workshops, facilitation support, peer pressure, and homework assignments relevant to each water system. More detail on the PBT process is provided in another article in this issue of *AWOP News.*

At the conclusion of the first round of PBT, Alabama determined that a problem existed with the third session (coagulation control tool development) related to how to teach jar test calibration. Alabama staff realized that additional information was needed beyond that which was provided by TSC and PAI during the Region IV training session. Alabama made changes to the third session based upon studies conducted at a treatment plant and consultation with PAI. During round two of PBT, session three was expanded to two one-day sessions held approximately 45 days apart. The first day taught the jar test spreadsheet and the second day taught how to conduct a jar test calibration study.

Still unsatisfied with the results from the third session, Alabama made further refinements to the process. State personnel realized that the Jar Test Spreadsheet was only useful in obtaining initial jar test settings and the actual results for a calibrated jar test could vary significantly. With this realization the workshop changed from two sessions held approximately 45 days apart to a two day back-to-back session. Enhanced coagulation was also added to keep all jar testing tools in the same session. This revised session was conducted in mid May 2004 during the third round of PBT. The revised session was well received and understood by the water systems.

While session three was being revised, Alabama decided to add another session between sessions three and four. This session would deal with disinfection byproducts. This session dealt with historical data for TOC, DBP's, Contact Time (CT) and water age (storage tank turnover). After showing the systems how to use the Excel spreadsheets, the workshop turned to control strategies and how making a change could impact another part of a water system.

Alabama has completed a modified PBT round in 2004 that was called "PBT Lite." PBT Lite had two main objectives from the state's perspective – to see if PBT could be as effective on an accelerated schedule and to determine if DWB staff would be able to successfully conduct two PBT rounds at the same time. Neither objective met with much success. Systems felt that the accelerated schedule did not allow enough time for homework assignments and special studies. DWB staff realized that conducting two simultaneous PBT rounds while still keeping up with compliance and enforcement activities demanded too much time. It was decided that the optimum schedule for PBT in Alabama is a single round conducted over nine or ten months.

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Alabama's AWOP *...continued from page 4*

Lessons learned from PBT

- PBT sessions must be tailored to fit the group of systems that are participating.
- Most major issues in a treatment plant are usually comprised of many smaller issues.
- Conducting PBT in less than nine months is not feasible.
- Conducting simultaneous PBT rounds is very time consuming.
- Water treatment plants should not have completed any major construction activity for at least a year before the start of PBT.
- PBT builds relationships between systems that never would have spoken to each other otherwise.
- Most plants have at least one filter that a majority of the time is the worst performer.
- Water treatment plants should be operated based upon the season of the year to deal with changing raw water characteristics.
- Flow splitting in treatment plants can impact overall performance.

For more information on Alabama optimization program, contact Chris Griffin at cmg@adem.state.al.us or (334) 271-7775 or William McClimans at wdm@adem.state.al.us or (334) 394-4368. ■

AWOP Quartery Meeting Update

One of the key components of a multi-state area-wide optimization program (AWOP) is the quarterly meeting held between participating state program personnel, EPA, ASDWA, and the contractor, Process Applications, Inc. These meetings are part of the strategic implementation process used to sustain the AWOP partnerships and activities. The meetings accomplish multiple objectives including sharing ideas, agreeing on direction and priorities, providing multi-state support and encouragement to improve program performance, and sharing technical and management information and approaches. Each of the four Regional AWOP Programs held meetings since the last issue of *AWOP News* in May.

The Region 4 meeting was held in conjunction with a field-training event that focused on developing skills for jar test calibration. The meeting was held in Columbia, SC and two plants were selected for the field activities – one facility was a conventional plant with separate flocculation and sedimentation zones and one facility had a reactor type flocculation and sedimentation unit. Jar test calibration training is an integral part of the Performance Based Training (PBT) approach used to improve the performance of multiple water treatment plants. The jar test training has been revised based on field results from numerous PBT programs. The field training efforts allowed the state and regional participants to learn the new techniques and training emphasis so that they could apply the approach to their PBT efforts. Each of the states was requested to practice the calibration techniques at a plant of their choosing in their own state and to report back on their results at the next quarterly meeting.

The Region 3 activity was not a typical meeting, but instead was a multi-state Comprehensive Performance Evaluation (CPE) effort. The CPE was conducted in Cameron, WV and had multiple objectives. The event served as a training event for some of the state participants that had never conducted a CPE. It also allowed those states that conduct CPEs or other evaluations, such as the Pennsylvania Filter Plant Performance Evaluation, an opportunity to demonstrate their approaches and nuances to the various state participants. The event also served to enhance communication and the working relationship between the state AWOP participants. This was the first Targeted Performance Improvement Component activity for the Region 3 AWOP. Past efforts had focused on the development of their Status Components.

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Developing a State AWOP*...continued from page 1*

Developing a TPI Strategy

Background

Implementation of the TPI component is so much more than just doing Comprehensive Performance Evaluations (CPEs)! It is true that state personnel involved in the four multi-state AWOPs currently facilitated by EPA and Process Applications, Inc., learn how to conduct CPEs and Performance Based Training (PBT), which are proven performance improvement tools. However, these TPI tools need to be incorporated into a broader statewide TPI strategy that identifies a process of utilizing coordinated, complementary state activities, all ultimately contributing to optimized performance at individual treatment plants within the state.

Upon completing its status component, the first step for an AWOP state to take under TPI is to develop (and then maintain) an overall TPI implementation strategy. The TPI strategy should link the plant performance data collected during status component implementation to the effective use of available TPI tools. The state can then utilize this information to prioritize activities and effectively use state resources to address performance problems and therefore enhance public health protection.

Once the state knows *where* to target its efforts, the question of *how* to have an impact on plant performance must be addressed. The choice of which TPI tool to apply at a water treatment facility requires an understanding of how each tool works, the resources required for its application, and a working knowledge of the "personality" of the water system personnel. One strategy that a state may choose to employ is to group the surface water treatment plants based on the level of performance, hence public health protection provided – low, medium, and high – and then determine which TPI tool is appropriate for each category. In general, it is currently assumed that plants exhibiting poor performance require a greater effort (thus a greater level of state resources) to identify and address the unique combination of performance-limiting factors existing at those facilities. Plants exhibiting average to high levels of performance require fewer state resources to address performance limiting factors.

Elements of a TPI Strategy

One of the principles of AWOP implementation is that each individual state can tailor its program using activities that are relevant to that specific state drinking water program. AWOP provides a framework for a state to merge optimization activities and the day-to-day operations of a state drinking water program such that all the efforts combined result in improved treatment plant performance. Therefore, a state may develop its TPI strategy by including (but not being limited to) the following elements:

- Learn how to apply AWOP TPI tools (CPEs and PBT)
- Assess existing state activities as potential TPI tools
- Modify Existing Activities to Include a Performance Improvement Focus
- Determine applicability criteria for each TPI tool
- Identify available state resources for TPI implementation
- Identify & train staff for implementation of the TPI component
- Maintain the TPI component

The remainder of this article will describe each of these elements in greater detail.

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Developing a State AWOP *...continued from page 6*

Learn How to Apply AWOP TPI Tools (CPEs and PBT)

Participation in facilitated multi-state AWOPs provides state personnel with experience in conducting CPEs and PBT. A CPE is actually the first step of a Composite Correction Program (CCP), which also includes Comprehensive Technical Assistance (CTA) as a follow-up step to the CPE. The fundamental difference between CCP and PBT is the focus of the effort. CCP is designed to identify and address the *unique* combination of performance limiting factors at an individual facility where it is applied, whereas PBT is designed to address *commonly occurring* performance-limiting factors at a typical treatment plant. These commonly occurring factors are based on factors identified through application of CPEs at over 100 facilities in approximately 25 states. A brief description of the CCP tool is provided in the sidebar and an article providing a more detailed description of PBT appears in this issue of *AWOP News*.

Application of the CCP to address the unique combination of performance limiting factors at a given treatment plant can be resource intensive, but has been effective at systems exhibiting poor performance from their treatment processes. PBT addresses commonly occurring factors limiting performance and is implemented with several water systems simultaneously. PBT is less resource intensive than CCP, and has been effective at systems achieving average or better performance from their treatment processes.

Experience with these tools allows state personnel to understand fundamental differences between a performance improvement tool and an assessment of "best management practices," which form the basis of many inspections.

What's CCP?

CCP = CPE + CTA. CPEs are evaluations conducted by a minimum of two evaluators at a surface water treatment plant over a 3-5 day period. A CPE assesses the level of performance achieved at a facility and includes a thorough review and analysis of its design capabilities and associated administrative, operational, and maintenance practices as they relate to achieving optimum performance from the facility. A CPE results in identification of performance-limiting factors and a determination of the potential for optimized treatment performance without major capital expenditures

A CTA follows a CPE to address the unique combination of performance limitations identified during the CPE. CTAs are conducted by a facilitator, typically involve four to five site visits and generally last between 12-18 months. Phone calls are made by the facilitator to a contact person at the plant between site visits to keep the effort on track. The focus of the CTA is to transfer priority setting and problem solving skills to plant staff while helping them achieve optimized performance from their facility.

More detailed descriptions of these tools are available at http:/www.asdwa.org/awop/awop.html.

Assess Existing State Activities as Potential TPI Tools

Assessing existing state activities as potential TPI tools begins with an inventory of the various activities that the state undertakes at plants throughout the year. Examples include inspections, sanitary surveys, filter evaluations, self-assessments, administrator and operator training, direct technical assistance, and third party technical assistance. State personnel should assess these activities and determine how each supports the goal of improved plant performance.

Modify Existing Activities to Include a Performance Improvement Focus

Some AWOP states have modified their sanitary survey protocols to incorporate optimization activities. In South Carolina, optimization-related activities have been incorporated into the sanitary survey process. Examples of these activities include:

- A review and analysis of the raw, settled, and finished water turbidity profiles with

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Developing a State AWOP*...continued from page 7*

PWS staff. Possible causes of turbidity spikes are discussed, as is plant performance relative to the AWOP goals. The South Carolina sanitary survey form was modified to identify whether or not the treatment plant achieved the AWOP goals for turbidity over the past year. The sanitary survey exit meeting and written report both include a presentation on the public health benefits of achieving the optimization goals for turbidity.

- An assessment of the filter backwash capability by measuring bed expansion and rise rate. The South Carolina Bureau of Water has assembled and distributed a Filter Assessment Manual to its PWSs to assist them in optimizing the filtration process.

When a sanitary survey in South Carolina uncovers operational issues limiting performance of a water treatment plant, the state may schedule follow-up site visits to provide technical assistance in areas such as performing filter assessments, calibrating turbidimeters, and calibrating chemical feed pumps. As the South Carolina AWOP expands its technical scope to include DBP control, the Bureau of Water will be investigating some distribution system focused activities, such as tank turnover assessments, for inclusion in its sanitary survey program.

In addition, South Carolina utilizes its enhanced sanitary survey program to encourage PWSs to achieve optimized performance, and to join organizations such as the Partnership for Safe Water, which also promotes optimization of water treatment processes. PWSs meeting the optimization goals are encouraged during sanitary surveys to be proud of their commitment to public health protection and to include this information in their Consumer Confidence Reports.

Determine Applicability Criteria for Each TPI Tool

The performance status of a water plant helps determine the most effective TPI tool to use in each situation. However, an effective strategy also includes the judgment of the state staff regarding water system intangibles when assessing potential impact of a given TPI tool to improve performance of a treatment plant. For example, performance based training is an effective TPI tool for plants achieving average levels of turbidity removal. However, it has been shown that mixing some systems achieving high levels of turbidity removal in with plants achieving lower levels of removal can enhance the performance of all of the systems during PBT activities. In addition, PBT might not be appropriate at some systems, regardless of their levels of plant performance. Participation in PBT requires a commitment from both plant staff and their administration to participate in the program for a period of approximately 15 months. Therefore, a system that does not have buy-in from the operations staff and system administration would not be a good candidate for PBT.

Identify Available State Resources for TPI Implementation

Preparing a TPI component implementation strategy should include identification of what TPI activities are already being performed, and which ones represent additional tasks that the state drinking water program would need to undertake. Additional TPI activity will likely be limited by the resources available to pursue the work. Therefore the strategy should reflect which of the TPI tools are appropriate for each state program's situation.

An estimate of the number of events to which TPI tools can be applied versus an estimate of the needed number of events to achieve a certain area-wide performance goal will assist in identifying resources needed to achieve the area-wide performance goals. However, a state should have a variety of TPI tools available and ready to apply according to the various performance levels, individual plant situations, and available state resources.

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Identify and Train Staff for Implementation of the TPI Component

Once the state has an inventory of TPI tools and list of surface water treatment plants that would benefit from additional assistance, the state should determine who will implement the TPI component. Various combinations of state central office and/or district office personnel and/or a third party provider can work. It is important to have an adequate number of staff involved to keep the program viable even when impacted by staff turnover and excessive workload.

Maintain the TPI Component

Maintaining the TPI component includes four main activities: 1) documenting results; 2) providing on-going training for TPI tool implementation; 3) continuously assessing TPI tool effectiveness and applicability; and 4) incorporating the findings of TPI component implementation into other drinking water program areas.

- *Document Results:* TPI efforts with water treatment facilities generally require significant staff time and state resources to complete. Documenting the results of these efforts is important to justify the expenditure of state resources and can help garner and maintain state administration support for the optimization program.
- *Ongoing Training for TPI Tool Implementation*: States participating in the multi-state AWOP with EPA's Region IV office have routinely offered other partici pating AWOP states the opportunity to participate in joint CPE and PBT events. This has been very successful in keeping staff implementation skills sharp and for providing lots of opportunities for new staff to obtain training. Elsewhere, any states working through third party providers generally need to have at least a basic understanding of the different tools to ensure quality assurance and long term viability.
- *Assessing the Effectiveness of the TPI Tool*: The intended goal of TPI activities performed by state or third party personnel is to facilitate water systems in achieving optimized performance. Any tool utilized should be assessed to determine its effectiveness at improving water quality at individual water systems. The status component will provide this information by tracking plant performance and showing how individual plants change on the priority list after TPI implementa tion. TPI tool applicability criteria and implementation may then need to be modified in order to have an impact on plant performance for those systems showing little or no improvement in the quality of water produced.
- *Incorporating the Findings of TPI Component Implementation into Other Drinking Water Program Areas*: Results of TPI activities can provide useful information for many drinking water program processes, thus maintaining internal support and interest in the TPI activities. For example, states can use CPE results to modify operator training curricula to address plant operations issues identified, to assist in the evaluation of loan applications for proposed capital improvement projects, and in state design review and permitting processes. ■

Do You Have Something to Add?

If you have an idea for a newsletter article or materials to add to the AWOP web page, please contact Matt Corson at mcorson@asdwa.org.

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Performance Based Training Approach

PBT represents a unique training approach over more conventional operator training. Instead of having training sessions in a classroom over a short time period (e.g., a day or week), PBT consists of five one-day sessions over a 12 to 15-month period. In addition to classroom sessions, three of the five sessions are conducted at a plant site.

Unique Aspects of PBT

The PBT approach includes the following unique aspects:

- Each plant tracks its performance before, during, and after the training so that operators learn the value of using their data for process control and being accountable for long-term tracking of performance. This data tracking also allows for a performance based success measure for the training.
- Operators learn how to implement the concepts obtained from classroom training in the day-to-day operation their facility.
- Along with technical training, the operators learn skills in setting priorities and problem solving so that they can properly respond to unusual conditions.
- Operators learn to address administrative and design limitations as well as operation and maintenance challenges mainly through leadership and management skills training.
- Each session includes a related homework assignment that allows the operators to apply their new knowledge at their treatment plant and report back to the group at the next session on what they have learned.
- Between each session, a facilitator makes periodic phone calls to the operators to assess progress with the homework and discuss any implementation obstacles.
- The plants are required to make several commitments and meet certain requirements in order to participate, including: the same participants should attend all formal training sessions; utility administrator(s) should attend the first and last formal training sessions; and participants must complete the homework assignments associated with the training

PBT Sessions

PBT currently focuses on optimizing particle removal from surface water treatment plants. Five sessions conducted over a 12 to 15-month period are used to address this objective. The sessions are progressive in nature, with each session building upon the previous session. The session topics address the highest-ranking performance-limiting factors observed over the years. The sessions are as follows:

- PBT Session 1 – Adoption of Optimization Goals and Development of Data (Software is provided to track progress of the training.)
- PBT Session 2 – Developing Priority Setting and Problem Solving Skills (Participants are taught the scientific method to evaluate their utilities.)
- PBT Session 3 – Coagulation Control Tool Development (The approach to achieve jar test calibration is taught.)
- PBT Session 4 – Assessing Current Plant Performance/Applying Skills and Tools
- PBT Session 5 – Reporting on Success

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State Personnel Roles and Responsibilities

When a state first establishes PBT capabilities within their AWOP, outside trainers conduct the five one-day sessions and the state personnel are trained as facilitators. These facilitators play a key role in the success of the PBT efforts by maintaining contact with the plants and providing focus for their efforts. The outside trainers provide facilitator training for the state personnel prior to the start of the formal PBT sessions. The state personnel also learn the technical content of the sessions in conjunction with the training for the plant participants.

PBT Impacts

To date, those states and plants that have participated in PBT have experienced two types of impacts. Along with improved performance, there have been other intangible impacts that make PBT an even more valuable training activity

Performance Impacts

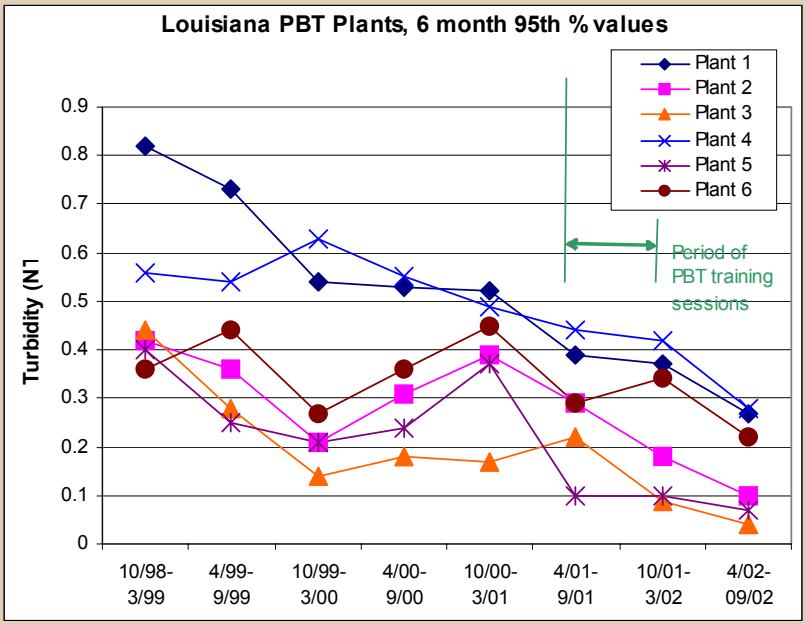
The impact of PBT on plant performance for several of the pilot projects was significant. Nineteen of the twenty-one facilities that participated in these pilot projects were small systems (< 3,300 population served). Before the training was initiated, only four of the utilities were producing water consistently less than the LT1ESWTR requirements for finished water of 0.3 NTU. Immediately following the training, 18 facilities were able to consistently meet the LT1ESWTER requirements. Of these 18 facilities, 16 were able to meet the LT1ESWTR requirements for six months or greater. Six of the facilities were able to achieve the optimized performance goal of 0.10 NTU following the training.

Figure 1 contains performance data for six plants that participated in some of the early development work in Louisiana. In all cases, these plants demonstrated improved performance during and after the completion of PBT.

These performance improvements are significant in that they were achieved with existing facilities and staff, and most of the utilities were small systems that are often challenged in meeting the new regulations. It is significant that some of the facilities were able to achieve the combined filter turbidity goal of 0.10 NTU with existing facilities and without capital outlays. Continued performance improvement is anticipated from most of the facilities due to the skills transferred during PBT.

A key reason for these performance improvements was the problem solving skills that the participants developed. The special study format allows the participants to systematically solve the myriad of problems that typically inhibit a plant from achieving optimum performance (i.e., they learn to utilize their facility as a place to conduct "research" on identified problems).

Figure 1. Optimization Diagram



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Intangible Impacts

Both the operators and the facilitators realized significant intangible impacts from their participation in PBT. During the 12 to 15 months of PBT, an increase in the participants' skills and responsibilities was observed in each of the pilot projects. Common observations included increased confidence in public speaking, improved documentation skills, confidence in unit process operation, confidence in priority setting, increased focus on unit process performance, and motivation to continue the optimization process. These leadership and management skills were developed gradually during the training series. The often stifled discussion at the first sessions gave way to enthusiastic communications with all of the participants during the later sessions. Communication among participants, both informally and formally, during the workshops is a significant component of the training and skills transfer.

The participants established a network of operators, trainers, and facilitators that they feel comfortable in contacting, even following the training sessions. This communication network is a valuable side benefit of the PBT approach.

Another valuable aspect of PBT is that the participants learned skills to document needs through special studies. This data-based approach provides the operators with tools to approach managers with requests for changes to staffing and facilities

Facilitators also acquired valuable training skills by learning to: 1) transfer priority setting and problem solving skills to the participants and 2) avoid trying to troubleshoot problems from a remote location. A majority of the PBT facilitators have indicated that their role as PBT facilitators has greatly enhanced their understanding of the issues facing operators and their ability to lead operators in the formulation of solutions to their own problems.

Conclusions

The Composite Correction Program provided the experience base for achieving optimized performance from existing surface water treatment plants. Recent and proposed regulations along with increasing challenges in providing public health protection necessitated the need to develop a new training approach that would impact performance at multiple systems. The PBT protocol was developed and demonstrated at twenty-one water utilities; and, in almost every case, improved performance was achieved.

PBT provides an alternative to conventional training, and it has been demonstrated as a viable approach for achieving improved performance from existing facilities. Individuals and organizations contemplating training for water or wastewater operators should consider this "new way of doing business." ■

1. Hegg, B.A., L.D. DeMers, J.H. Bender, E.M. Bissonette, and R.J. Lieberman. 1998. Handbook: Optimizing Water Treatment Plant Performance Using the Composite Correction Program – 1998 Edition. EPA/625/6-91/027 Revised August 1998, USEPA Center for Environmental Research Information, Cincinnati, OH.

2. Hegg, B.A. and L.D. DeMers. Performance Based Training: A Proven Approach to Improve Water Treatment Plant Performance. Presented at American Water Works Annual Conference, Anaheim, California (June 15-19, 2003).

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AWOP Quarterly Meeting Update...*continued from page 5*

The Region 10 quarterly meeting held in July in Kent, WA included an introduction to PBT. The session familiarized states with the PBT process, allowed the states to assess the resource requirements, and helped them to begin to formulate their level of involvement. The introduction session will be followed by the states actually participating in the PBT activities with the understanding that they are the future trainers and facilitators (i.e., EPA and Process Applications, Inc. personnel will be training the future trainers). The states may or may not choose to be trainers in the future, but the concept of the training approach is to allow the states to define their role based on actual experiences and activities. Please see the related article on PBT in this issue of *AWOP News* for further explanation of the PBT process.

Region 6 held two meetings since the last issue of *AWOP News*. The first meeting was coupled with a training event where jar test calibration skills were demonstrated at two plants in Louisiana. One conventional and one reactor clarifier plant were used for the demonstrations. The second meeting was held in Dallas, TX and included each of the states reporting back on calibration activities that they had implemented since the jar test calibration training session. Implementing the jar tests calibration activities served to increase the confidence of state personnel in the techniques and their ability to train others if they so choose.

Future activities are scheduled as follows:

Date	Activity
Week of January 10, 2005	Region 6 Quarterly Meeting and Field Event – Arkansas
Week of November 8, 2004	Region 10 Quarterly Meeting and PBT Session 1 – ID
Week of November 15, 2004	Region 4 Quarterly Meeting and Jar Test Results – KY
Week of April 4, 2005	Region 4 Quarterly Meeting – Georgia
Week of May 9, 2005	Region 6 Quarterly Meeting – TBD
Week of July 18, 2005	Region 4 Quarterly Meeting – North Carolina
Week of November 14, 2005	Region 4 Quarterly Meeting - Alabama